

## **Cerro Grande Fire Behavior Narrative**

### **May 6-May 24, 2000**

This document details the fire behavior narrative for the Cerro Grande Fire. Larry McCoy, FBAN for Humphrey's Incident Management Team, completed the narrative for the period of May 6 through May 16. Sue Husari, FBAN for California Incident Management Team 3, and Kelly Close, FBAN, provided additions for the North Zone of the fire starting May 14 and the entire fire starting May 17. The narrative also includes observations made by Bill Jackson, FBAN for Bateman's Incident Management Team and Jesse Dunchrack, FBAN.

#### **May 6**

The Cerro Grande Fire started on May 6 when an escaped prescribed burn was declared a wildfire. A type 3 fire organization was organized and reinforcements were ordered. The fire had sloped over control lines into heavy mixed conifer and pine and was working its way up a southern aspect and on to an east aspect in a small north-south running drainage. Two Hotshot Crews attempted an indirect attack with burnout as a way to control the spread. Line construction was completed by the end of the day but burnout operations continued on through the night and into the next morning. 13:00 hour observations from the Jemez RAWS station was showing 1 hr fuel moistures=1, 10 hr=2, 100 hr=4, and 1000 hr=11.



#### **May 7**

The southern control line was State Highway 4 and runs in an east-west direction. In the middle of the fire area the highway had to take an abrupt 90-degree turn to the north as a result of a very steep canyon. The road went due north for ¼ mile before crossing the canyon and then taking an abrupt turn to the south for ¼ mile, which then made an abrupt turn back to the east. The result was a severe dogleg in the line where they were attempting to burn out the line to secure it. During the burnout operations strong west winds pushed spot fires into the bottom of the canyon where it built up in intensity crowned out and made a strong run up out of the canyon bottom to the road and back into the back of the original control line. From this run another spot developed at the top of the ridge above the road

and outside the burned out area. It was estimated that the spot fire grew slowly for an hour or so before it crowned out in the early afternoon and with a strong west-southwest wind pushed the fire to the east northeast with extreme fire behavior for approximately 4 hours. Estimated rate of spread was 55-60 chains per hour with passive and continuous crown fire. Total distance for the head fire run was approximately 3 miles. Lateral spread averaged 1.25 miles for an approximate 3:1 ratio.



By late afternoon, the winds began to subside and the fire began to decrease in spread and intensity. The hotshot crews backfired the May and 501 roads. Burnout operations began approximately  $\frac{3}{4}$  mile up the May road and were brought east to the May road and 501 junctions. The burnout operations then proceeded south along the 501 road for approximately 1 mile where it joined the southern edge of the fire spread. At this time firing operations were suspended as spread of the main fire had joined the burnout operations and spread was put into check.

Fire spread during the evening was minimal in response to decreasing winds, and lower fuel temps and higher RH. The backfire along the May and 501 roads only spread about 10-12 chains to the interior.

## May 8

A “Red Flag Warning” for strong west winds and low relative humidity was posted for the day shift with winds shifting to the northwest by late afternoon. Fire behavior predictions for the pine and mixed conifer called for high rates of spread with torching and crown runs with spotting up to  $\frac{3}{4}$  mile. Winds were strong and gusty at times but temperatures were 5-6 degrees cooler and relative humidity was up 15% above predicted values. As a result, fire behavior was moderate over predicted values.

By late morning burnout along the 501 Rd was initiated. The burnout started where the previous days burnout had stopped and proceeded south to the 4 road. The higher relative humidity and a favorable wind direction allowed for burning to continue throughout the day. Cerro Grande peak afforded protection from the west winds and convective heating of the east facing aspects created a south to southeast wind along the 501 road. The burnout along the road was halted at Water Canyon as evening approached and the predicted wind shift out of the west-northwest occurred.

The cooler temperatures and higher relative humidity supported only minor interior spread with some

torching and short canopy runs up to the top of ridges in mid-slope mixed conifer stands with heavy fuel loading. Close range spotting occurred on the backside of the ridges with no down slope movement. The best fire behavior occurred in the lower elevation pine that moved about 30 chains to the north. Rates of spread were estimated at 5-6 chains per hour pushed by a southerly wind.

Burnout on the May road to the west was attempted during the night shift but conditions to support fire spread deteriorated by 2200 with only a ¼ mile burned. The burning that occurred was very dirty due to the lighter fuel loading in a pine fuel model (9).

## **May 9**

The two-day predictions for winds on the fire were for northwest winds 25-30 mph in the morning transitioning to 15-20 mph out of the west in the afternoon. On the 10<sup>th</sup> winds were to shift around to out of the southwest. As a result, predicted winds were favorable to burn out the northern control lines on the 9<sup>th</sup> and the southern control lines on the 10<sup>th</sup>. Burnout was initiated on the morning of the 9<sup>th</sup>. The burnout operation started at Pajarito Peak and proceeded south-southwest to the saddle between Pajarito Peak and Cerro Grande Peak. At the same time, burnout operations proceeded east down the ridgeline at the edge of the ski area to the May road along the ridgeline and constructed dozer line.

The projected northwest winds did materialize at the ridge tops but were too light to mix down below on the east aspects. As a result, upslope winds were pushing the burnout back in on itself and smoke was blowing across the line. Burnout was proceeding slower than anticipated as a result. No spots resulted from the burnout. Burnout of the north line was as low as 5 chains deep and as much as 15 chains deep at the lower end where fuel types and dryer conditions supported better spread. When night shift arrived on the fire they began burning along the east end of the May road where the burnout had ended from the previous days activity and attempted to bring the burnout west to tie in with the burnout operation proceeding east from the ski area. The two operations were unable to tie the line together due to deteriorating burning conditions after sunset.

On the south end of the fire at Waterman Canyon with the warmer and dryer conditions in the pine type, the fire backed south through the canyon and was making runs up the north aspects with some torching. The fire hooked around and spread to the 501 road where eddy winds, due to the influence of Frijoles Canyon and the steep terrain to the west, was causing spots across the road. Fire behavior predictions for that area called for rates of spread 6-8 ch/hr, flame lengths 3-4 feet, torching and short canopy runs, spotting up to 1/3 mile with a P(I) of 80%. The prediction for spot fires also included that these spots would be well within the capabilities of hand crews and engines. All spots were immediately suppressed with the largest one at 2 acres. As a result of this movement south and with favorable winds, it was decided to begin a burnout along the 4 Rd at the first switchback above the 501 and Rd 4 junction. This burnout proceeded west along the 4 Rd and to the Rd 4 and 501 junction where it proceeded north and tied into the fire now backing south along the 501 Rd.

When these two lines of fire were joined burnout proceeded south and west along the 4 Rd. Night shift continued the burnout through the night for approximately 1 mile. Heavy fuel loading along the road supported burning through the night where torching and short canopy runs upslope were observed. The depth of the burn averaged anywhere from 6-12 chains deep by midnight and some fingers continued to spread through the night but no information on how far was available.





*Looking at the 4 road from the 501*

At mid slope fire continued to back in the pine type throughout the day. Total backing spread averaged 15 chains for the day. In the mixed conifer at about 9000 feet spread up canyon with the upslope winds for the day averaged 10-15 chains with some torching and short canopy runs to the tops of ridges. These runs terminated at the ridge tops and no backing was observed down slope on the north aspects. Some short range spotting occurred over the ridge. Those fires that did back down slope during the day in the lower elevations only moved an average of 2-5 chains.

## **May 10**

The morning forecast called for a “Red Flag Watch” for strong and gusty winds, low RH and a Haines Index of 6. The Operational Plan for the day called for completing the burnout on Division E along the May Rd and extend it as far interior as time and fire behavior allowed. Fire behavior predictions for the day called for extreme fire behavior. Rates of spread in the pine and mixed conifer would approach 20-25 ch/hr with flame lengths in the pine 6-8 feet and 8-10 feet in the mixed conifer. This type of activity coupled with the heavy fuel loading would easily transition surface fire into the crowns doubling and tripling the rate of spread. Spotting up to  $\frac{3}{4}$  mile with the P(I) at 90-100% in the lower elevations along the 501 Rd and 60-70% in the higher elevations. Spotting into Los Alamos Lab area possible from runs coming out of Division B. Spotting into Los Alamos Canyon also possible from fire activity in unburned fuels to the south of the May Rd. There was no activity predicted for the urban interface contingency lines being constructed in Division D unless and escape occurs into Los Alamos Canyon. If this occurred then strong runs could be expected up the Canyon and into the community. A two-day projection was prepared based on escape occurring from out of Los Alamos

Canyon near the reservoir. The projection was based on a 14:00 escape and put a flanking fire moving into the west end of Los Alamos urban interface and moving interior up Pueblo and Los Alamos Canyons. By 1800 the projection put the fire just north of the Los Alamos and just a little south of Guaje Ridge trail by 2400. The fire was projected to reach the southern boundary of the Santa Clara Indian Reservation by 1800 on the 11th in the eastern end of Sawyer Canyon.

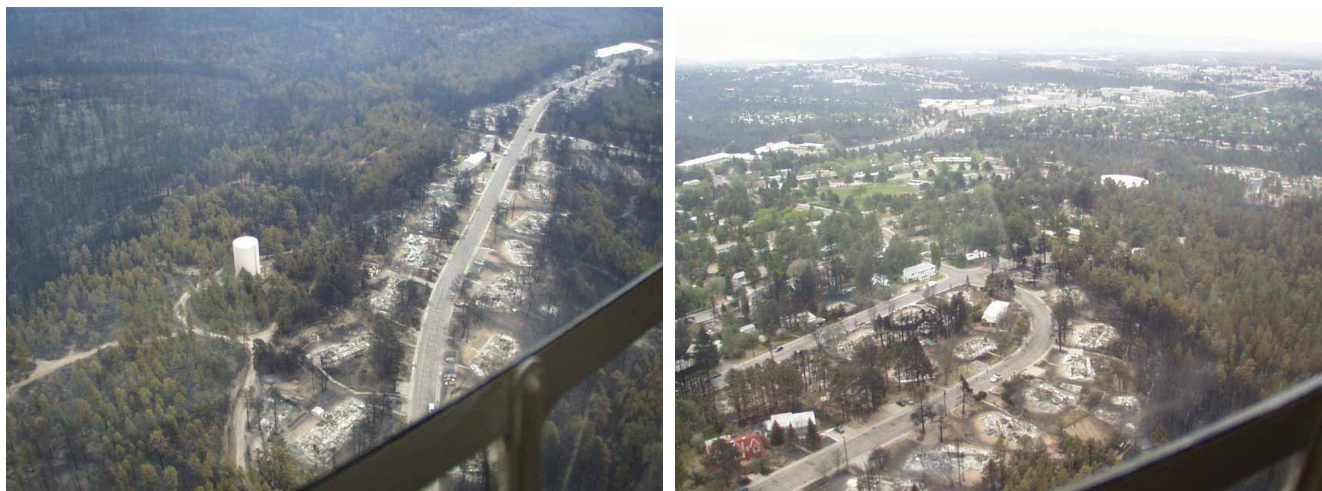
Relative humidity recovery was poor during the night and fire spread from the previous nights burning activities in Division B was continuing into the morning. By 11:00 relative humidity was dropping into the teens and fire activity in the unburned island north of Division B was dramatically increasing in response to slope, 10-15mph southwest winds, and heavy fuel loading. By 12:00 strong canopy runs and extreme fire behavior was occurring. Winds had increased at TA-49 to 13-14mph and gust to 35. Wind direction was favorable for keeping blowing embers going north and west of the 501 road and spots within the Los Alamos Lab were not occurring.



At 11:30 Division E was reporting a spot fire across the line north of the May Rd. They attempted to initial attack it with engines and hand crews but were unsuccessful. The spot crowned out and slopped into Los Alamos Canyon. At this time all crews were pulled into safety zones as fire activity on all fronts became extreme. It was estimated that the fire had worked its way up to the north ridge of Los Alamos Canyon by 13:00 where it transitioned into a crown fire and began its northeasterly march. The RAWs sites at the Technical Areas within the lab were now having sustained winds at 20mph with gusts to 40.

In Division B, winds were real erratic. A spot fire developed south of the 4 Rd and began to spread into the wind with a moderate rate of spread. Crews and engines began line construction from the western edge of the slop over to the east to try and cut off the head. Winds were pushing a small head fire with torching and short canopy runs along the southern edge of the 4 Rd with an estimated rate of spread 10-15 ch/hr and short range spotting. By late afternoon winds were continuing to increase with sustained winds at TA-49 at 24mph with gusts to 45. By 18:00 the field observer on Division B reported a crown fire that initiated on the south side of Rd 4 that jumped across the road in the crowns and created a short independent crown fire run to the top of the ridge across the burned surface fuels from the previous nights burnout operation. This run initiated a spot fire within the Los Alamos Lab 1 ¼ mile away from the crown fire run. By 2400 this fire ran 4 1/2 miles to the northeast in pine and pine-grassland fuels.

In Division D a flanking crown fire moved into the urban interface. Some areas on the northwest corner of Los Alamos received direct hits and fire moved into the interface two and sometimes three streets deep. In general the local fire departments were able to hold the spread to just the outer streets facing the wildland fuels. Spotting was profuse and many homes burned as a result of this type of spread. Through out the night fire continued to spread up some of the smaller east west drainages under and into homes on the ridgelines.



The fire stopped about 1/3 mile west of the Los Alamos Canyon Bridge but did spread about 1/4 mile up Pueblo Canyon and into the homes on the ridges above. By 18:00 the head fire was exiting the Los Alamos area and was just north of the town working its way to the east-northeast.

Winds were forecasted to slow after 20:30 but remained steady through the night with gusts to 35 mph. Spread after 18:00 took on a more east-northeast direction and instead of slowing down increased in speed to 75 ch/hr. This is a result of a change from mixed conifer and pine fuels to a more pure pine with grass understory. Fire spread ended in the Chupaderos Canyon after a 12-hour and 8 mile run averaging 55 chains per hour. Fire spread due to the strong southwest winds on the flanks was a 3 to 1.25 ratio. These strong winds helped to slow rates of spread up the steep canyons to the northeast.

## May 11

The morning forecast called for a Red Flag Warning with very strong winds, very low relative humidity, and temperatures much above normal and a very dangerous Haines Index of 6. Fire behavior predictions for that day included extreme fire behavior with rates of spread approaching 1.5 mph from spotting. Maximum spotting potential with the increase in winds could be as far as 1.5 miles. P(I) in the lower elevations was 100%.

Fire activity started early due to winds and poor relative humidity recovery. Fire suppression actions in the Los Alamos Lab area consisted of structure protection with limited suppression on the wildland fuels. As a result fire behavior was extreme all day within the Lab, which consisted of high rates of spread, torching, crowning and spotting. Due to the limited accessibility to the area as a result of security concerns no good information on spread and intensity was gathered. The head fire that developed ran an additional 5.5 miles to the east down canyons choked with pine. The fire also made significant runs to the north and southeast in response to heavy fuels and shifting winds.





Fire behavior predictions for spread to the north was extremely exaggerated. Information on fuels ahead of the fire was misleading and the fire growth was small due to very light fuels of Juniper and heavily grazed grass. Fire spread from flanking fires into heavier fuels to the north would have been consistent with the predictions of a 3/1 ratio. Fire growth in these fuels to the north averaged 1.5 miles. Fire spread as a flanking fire with torching all along the fire front and only slowed in very steep canyons protected from the wind.

Fire spread west up Los Alamos Canyon against the wind in heavy fuels for about a mile. Rate of spread was estimated to be 10-12 ch/hr with torching all along the fire front.



Fire spread on the remaining northwest flank spread 50 chains on the average against the west down slope winds through the day.

Within Los Alamos fire continued to spread up the smaller east west drainages underneath the homes on the ridges. A few more structures were damaged or destroyed. Smokes were popping up all along the original fire line keeping crews and engines scrambling. A burnout operation was conducted on the northeast side of town along Rendija Canyon to keep a backing fire coming off the south slopes and spreading fire on to the north slope below the homes on the ridge above. Crews supported by engines and heavy helicopters worked through the day and night to secure the canyon. Spot fires developed along the line due to strong and shifting winds. All spots were contained to two acres or less.



## May 12

Fire behavior moderated with cooler air, slightly higher RH, and a decrease in winds. Spread to the northeast in ponderosa pine with upslope winds and steep slopes were estimated to be 6-8 ch/hr in the afternoon with torching and short canopy runs. Two separate 1 ¼ mile runs to the northwest made it up to the south ridge of Santa Clara by 24:00 that night.

Very little spread was occurring in the higher elevations until late in the afternoon or right after dark. It appears that it takes all day for the fuels to recover from the modest RH recovery in the upper elevations with the cooler temperatures. Just after sunset, the west winds surfaced near the ridge tops and pushed the fire down hill for a ¼ mile run in mixed conifer. Division supervisors reported that this seems to be the best time for fire activity in the upper elevations.

In the Lab area, fire seemed to spread in all directions. The fire spread along drainages to the southeast during the day and covering anywhere from ½ to 1 mile in length. One run out of the influence of a northwest wind spread to the northwest for over a mile. The width was only 9-10 chains wide.

In the urban interface fire continued to move 10-12 chains up Pueblo Canyon where quick initial attack prevented any further loss of property.





## May 13

A change in wind direction brought in slightly higher temperatures and relative humidity. Stronger southeast winds occurred over the fire area and this offset the slightly higher RH. These winds enhanced the upslope winds allowing for good spread up Guaje and all the smaller Canyons to the north. Fire behavior predictions for this day called for spread in the mixed conifer 6-8 ch/hr with 4-6 foot flame lengths. The best run was up Guaje Canyon where rates of spread were estimated at 20-25 ch/hr with torching and strong canopy runs. This run was enhanced by stronger than predicted southeast winds of 20-30 miles per hour. The other canyons to the north spread 80 chains on the average for a 10-15 ch/hr spread rate. The North Operations group elected to begin burnout of Santa Clara Canyon. (refer to North Ops Records)

Inside the Lab area the fire became very active by late morning and spread to the north and east almost finishing off the remainder of the unburned lands within. Fire behavior was extreme much of the day with torching and short canopy runs. The fire spread down to the East Jemez Road threatening the homes above South Canyon on the north side.

No new spread occurred in the urban interface.

## May 14

The fire continued to back up into the canyons north of the ski area. Fire behavior predictions estimated rates of spread at 6-8 ch/hr for the higher elevation mixed conifer. The fire spread about 40 chains upslope in the two canyons to the north of the ski area.

The last little bit of unburned fuels along the East Jemez Road was burned out by crews and engines and held. This was the last area of spread within the Lab.

The fire burned actively on the south side of Santa Clara Canyon (north-facing slopes). The fire made major crown runs to the south rim of the canyon on May 13, and was now spreading into the canyon by backing downslope. Spot fires mid-slope resulted in intermittent uphill canopy runs to the ridgeline. Crews found several spots north of Santa Clara Creek from runs on May 13, with one spot fire in the upper portion of the canyon 0.5 miles from the active fire edge. All spots were quickly contained at less than 0.1 ac.

The fire backed steadily downslope at 1-2 ch/hr with 2-3 ft. flame lengths. Occasional uphill runs spread at 8-10 ch/hr, with flame lengths of up to 6-8 ft. Where jackpots of surface fuels generated increased intensity, surface fires initiated torching and short uphill runs through the canopy, often to the ridgeline. Short-range spotting occurred but did not result in fire spread outside established control lines. No spotting occurred to the north side of Santa Clara Creek.

By late afternoon, the northeastern portion of the perimeter had backed to near the canyon bottom. Firing operations at the east end of the canyon near the entrance station tied the fire's perimeter to the west side of Rd. 681 just east of that road's junction with Santa Clara Creek. The fire continued backing downslope through the night at 1-2 ch/hr, with 1-2 ft. flame lengths. Sustained uphill canopy runs were not observed, but intermittent torching was common throughout the night.



## May 15

A red flag watch for strong winds, low RH, and a Haines Index of 6 was issued for the fire area. Fire behavior predictions called for extreme fire behavior as a result. Winds did pick up in the morning and approached predicted values by late morning, when a thick cloud layer came over and settled over the fire area. As a result of shaded fuels, lessening winds, higher RH, and cooler temperatures the fire did not become active. Spread continued to the northeast in most canyons. The fire spread up Guaje Canyon for 30 chains throughout the day and into the evening.

The Santa Clara Canyon was sheltered from these winds to a large degree, except on upper slopes. As a result, no wind-driven runs occurred. Though the lower RH and instability during the day brought somewhat increased surface fire activity, no extreme fire behavior occurred. The fire continued to back downslope aggressively during the day with spread rates of 3-4 ch/hr. and flame lengths of 3-4 ft. By the end of the day, the fire had backed to Santa Clara Creek as far as the Ranger Station.

On upper slopes, the winds pushed the fire cross-slope in many locations, with surface fire spread at rates up to 8-10 ch/hr. and observed flame lengths of 5-6 ft. Intermittent torching occurred in the afternoon, with short-range spotting and occasional upslope crown runs; some of these runs ran from mid-slope to the ridgeline.

The fire burned actively into the night, with flame lengths of 1-2 ft. and backing spread rates of 1 ch/hr. Late in the night, fire activity diminished somewhat, but continued to back to Santa Clara Creek.



Firing operations during the night in the mid- and upper-portions of the canyon were effective in securing the perimeter to the south side of the creek approximately  $\frac{1}{4}$  mile east of the Ranger Station.

## May 16

Another strong low-pressure system was forecast to enter the fire area, prompting a Red Flag Warning for strong winds and low RH. Clouds associated with this system came over the fire area and put a lid on fire behavior as the day before. RH was much higher than predicted, and the clouds did not allow the stronger winds to mix down. Spread to the top of the ridges in all the canyons south of Guaje was accomplished. Fire also spread toward Caballo Peak in subalpine forest, aspen stands and tall fescue. No spotting was observed on the fire. Spread was estimated to be 40-50 chains for the day. The fire continued to back slowly through surface fuels and heavy fuels into Santa Clara Canyon. Activity increased after 2000, when clouds associated with the front passed through the area. In summary, the effects of the frontal passage were minimal because of the position of the fire in relation to wind direction, and the extensive cloud cover.



## May 17

Another Red Flag Warning was posted for strong winds from the approaching cold front. Clouds did not mix out as predicted and RH's stayed up with little mixing of the upper winds down to the surface. As a result, very minimal spread over the fire area occurred. Strong winds blew from the west all day. Fire spread on the northwestern area of fire. The fire backing into Santa Clara was going out on its own. No spotting was observed. Surface fire dependent torching was observed in subalpine fir/Engelman spruce forests at 9000 to 10000 feet. Runs were generally less than 100 to 200 feet. Fire activity in Guaje Canyon starting at 1230. High elevation meadows composed of tall fescue, a thick clumpy bunchgrass, burned slowly with flame lengths of 2-3 feet at low RH. There was no use of heavy helicopters and the fire was free burning in area between Santa Clara canyon and end of Pipeline.



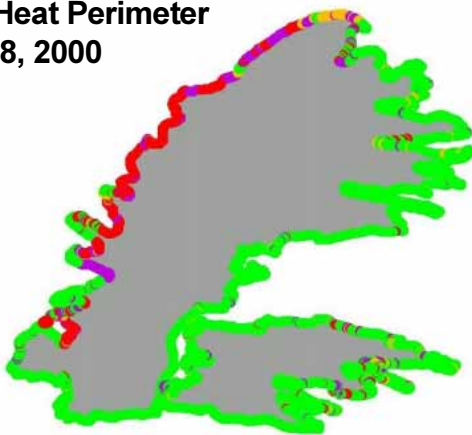


## May 18

Minimal spread occurred on this date due to cooler temps and higher RH. A small low spun off from the jet stream and caused more buildup over the fire than anticipated.

The fire edge in the Santa Clara drainage was noticeably less active based on visual and IR. Numerous smoldering areas remained on walls of Guaje Canyon. Burning aspen logs – mostly 100h and 1000h (3-8”) size, heavily influenced high elevation spread. One small run was observed in tall fescue on Caballo Mtn. Extensive use of heavy helicopter drops prevented most runs.

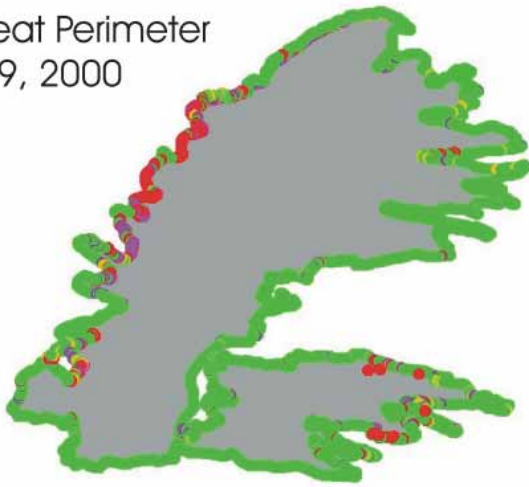
## FLIR Heat Perimeter May 18, 2000



## May 19

Rain was reported overnight. The RAWS stations show .02 to .04 inches of precipitation. Some strong gusts were reported during the night. Clouds were hanging on top of fire. The meteorologist revised the forecast at morning briefing to raise minimum RH. There was minimal fire activity. Line construction efforts were aided by moisture.

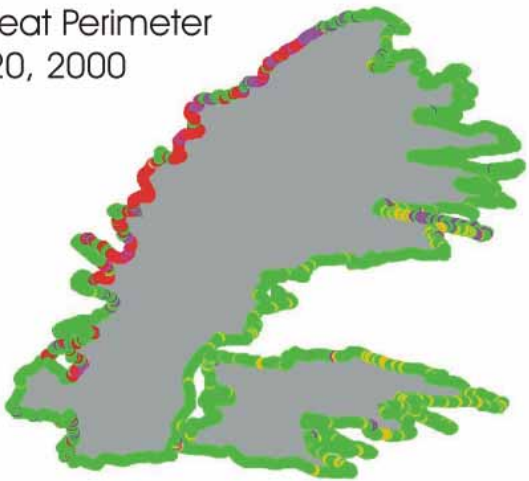
FLIR Heat Perimeter  
May 19, 2000



## May 20

Isolated thundershowers occurred over the fire. The relative humidity remained high. The fire was inactive and probability of ignition 50 percent. The meteorologist issued two supplemental forecasts related to thunderstorms in the fire area. The fire line was completed.

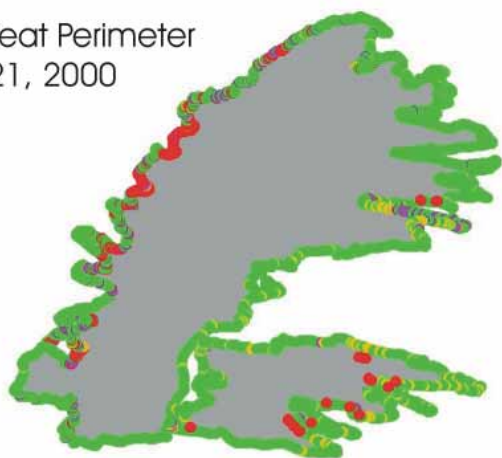
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May 20, 2000



## May 21

Humidities were lower than forecast and fire activity picked up in areas along the line. Probability of ignition increased to 70 percent. The fireline continued to hold. There was no significant spread on the perimeter of the fire. A few flare-ups occurred in Division U and crews were pulled out to the Pipeline as a precaution.

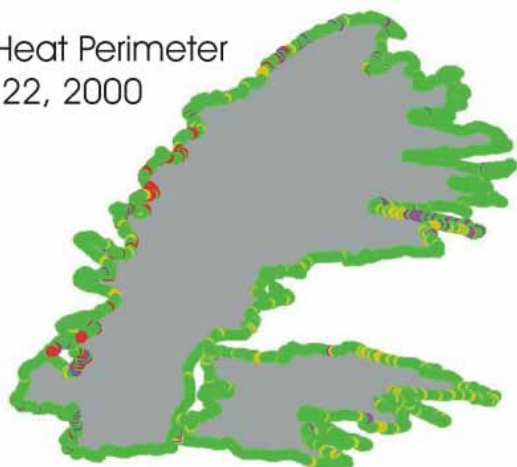
FLIR Heat Perimeter  
May 21, 2000



## May 22

Low RH and high temperatures continued to dry out the fuels along the fire edge. Probability of ignition increased to 90 percent. The fire remained within the constructed lines, but activity increased as fire crept through the litter and logs. The greatest area of fire activity was the north side and bottom of Guaje Canyon in Division U. Runs were kept to a minimum by water dropping helicopters. As a precaution, crews pulled out of the bottom of Division U due to low RH's and high temps. The FLIR flight indicated that the total numbers of hot spots along the edge were continuing to decrease as mop-up continued.

FLIR Heat Perimeter  
May 22, 2000



## May 23

Mop up and continued water drops had eliminated most of the hot areas along the fire line. Interior fuels continue to burn, especially in Guaje Canyon on Division U. Minor activity occurred on other divisions.





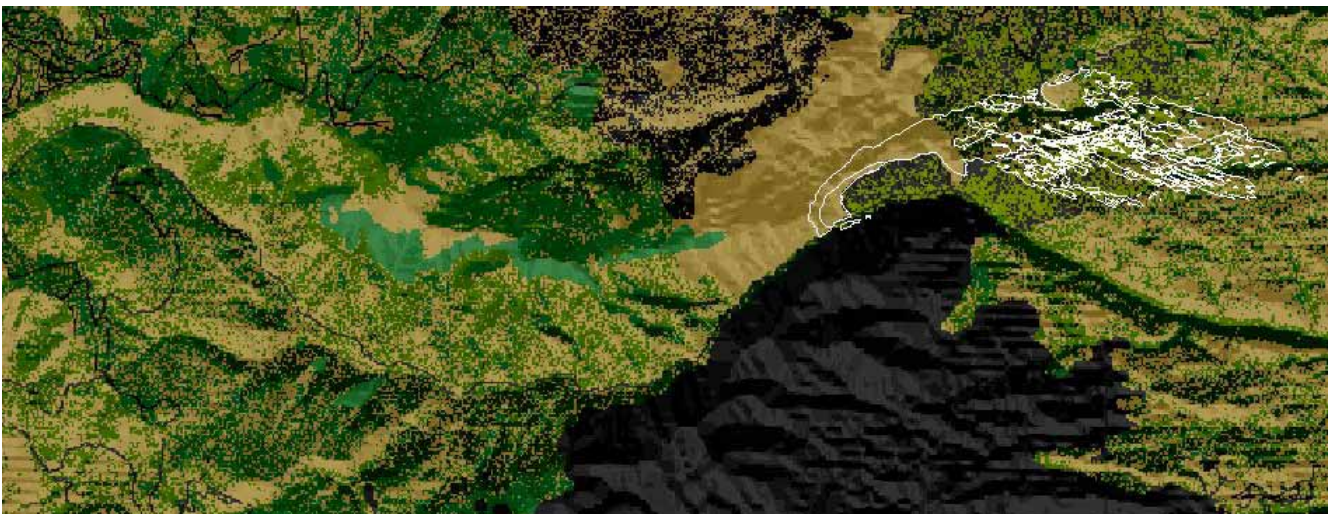
## May 24

Interior fuels continued to burn, though with limited fire activity due to afternoon cloud cover, cooler temperatures, and higher RH. Transition to a Type 2 Incident Management Team began at the 1900 hour planning meeting. A FARSITE analysis was completed on May 24. The observations in this narrative and the fire progression map were used to calibrate the model. The Potential Threat Map was used to determine ignition points along the May 24 perimeter for the projections.

The results of the projections indicated that spot fires or slop-overs along the west line (Divisions E, F, U, V and W) would spread at moderate rates even under worst case weather conditions. The most vulnerable location on the fire line was at the mouth of Santa Clara Canyon near DP53. A detailed report on the FARSITE analysis is available as an appendix.

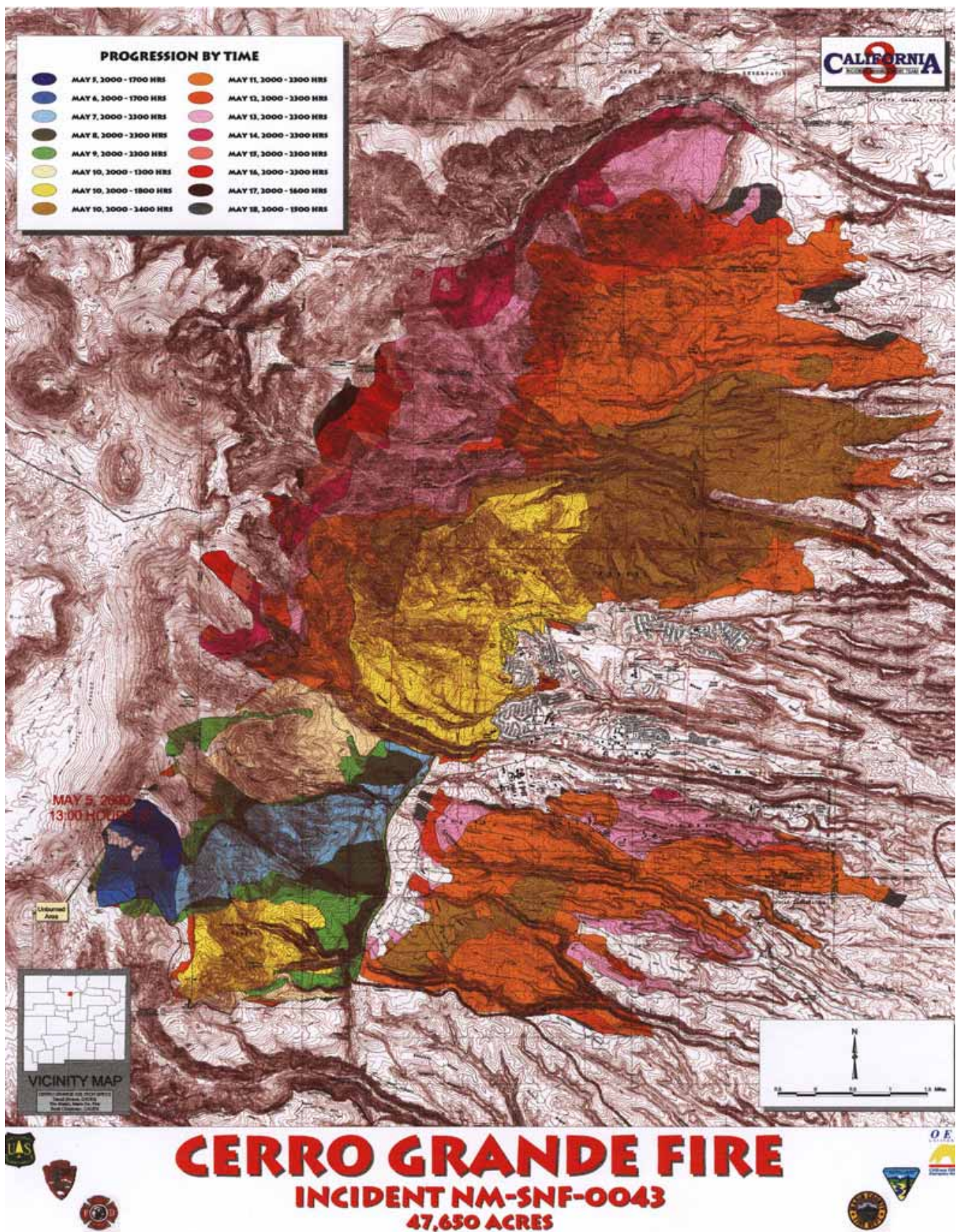
The FARSITE analysis team consisted of Kelly Close from the Poudre Fire Authority, Kevin Dougherty from the National Weather Service, Dave McCandliss from the Sierra National Forest, Tim Walsh from Marin County Fire Department and Sue Husari from the Pacific Southwest Region.

Acknowledgements: John Newman (FLIR maps), Katy Coulter (graphics and computer support), Elizabeth Cavasso (photographs), John Saltenberger (meteorologist), Dave Shreve (GIS), Scott Christopher (GIS) and Dan Kleinman (photographs and operational information).



*FARSITE perimeter growth projection for a potential spot ignition north of Santa Clara Creek, 1000-1800h, 5/26/2000*





*Perimeter growth by date and time, May 5-18, 2000.*